Remarks

Claims 1and 27-72 are pending in this application. By this amendment, claims 73-98 have been added. The new claims are directed to the embodiments shown in FIGs. 8m and 8n and are supported in the specification by paragraphs [0122]-[0125]. Claims 1 and 27-98 are therefore presented to the Examiner for consideration.

Applicant appreciated the Examiner's time in conducting a telephone interview on November 16, 2006 with the undersigned, the inventor and the inventor's agent. During the interview the inventor described the differences between the cited references and the claimed invention. Applicant further presented proposed amendments to the claims as well as new claims for the Examiner's consideration. The informal material discussed during the interview is now being submitted in this formal response.

Claims 1 and 27-72 have been rejected under 35 U.S.C. §112, first paragraph. The applicant has replaced the term "deflecting-focusing conductors" with the term "deflecting conductors" in claims 1, 44 and 60. This term is supported by the disclosure, and the focusing functionality of the deflecting conductors remains recited in the claim. This also corrects the missing antecedent in claim 28. Further, the term "semi-cusp" has been removed from the claims.

The applicant submits that claim 27 is supported by the application, for example Figure 8a which shows deflecting conductors **20a** downstream of the cathode, and deflecting conductors **20b** (which are the closing conductors for the deflecting coils **20** but generate an equal magnetic field in the opposite direction) upstream of the cathode. Many other figures show both deflecting and closing conductors, including Figures 3a,3b,5c,7. Reconsideration and withdrawal of the rejections is therefore respectfully requested.

Claims 1 and 27-72 have been rejected under 35 U.S.C. §112, second paragraph. The applicant has removed the term "near" from claims 1, 44 and 60 and replaced it with "a region of the focusing magnetic field where the deflecting magnetic field is too small to deflect electrons from the at least one plasma source." This is clearly supported by paragraph [0124], which references direct e-beam evaporation. It is further supported by paragraph [0131] in case of filtered arc ionized e-beam evaporation. In this case the e-beam source having a thermoionic filament installed near the crucible

for a 270° (or 180°) bent e-beam are positioned in the cathode chamber of the filtered arc source in the center of the cusp created by coils **220a** (downstream of the crucible linear conductors) and **220b** (upstream of the crucible linear conductors).

The applicant has changed the order of downstream deflecting conductors and upstream deflecting conductors in claim 29, so that the definite article "the" applies only to the downstream deflecting conductors. The applicant has also removed the term "near" in claim 29 and replaced it with "in." (The applicant believes the Examiner's reference to claim 28 is intended to refer to claim 29.) The applicant has replaced the term "near" with "adjacent to" in claims dependent 38, 40, 61 and 66. The applicant submits that the use of "cathode" in claim 44, line 21 and claim 66, line 12 is clear and correct. The applicant has changed "the plasma source" and "the focusing" [magnetic field] in claim 66 to "a plasma source" and "a focusing magnetic field," respectively. The applicant has also changed "overlapped" to "overlapping." In view of the foregoing amendments, applicant respectfully request reconsideration and withdrawal of the rejections under 35 U.S.C. §112.

Claims 44, 45, 47, 66 and 67 have been rejected under 35 U.S.C. §102(b) over Gorokhovsky. The remainder of the claims have been rejected over Gorokhovsky in view of a number of references including Ehrich, Bergmann, Buhl and Giersch *et al*. The applicant submits that the cited references, either alone or in combination, do not teach or suggest the combination of a filtered arc source and a metal vapour source in the manner recited by the claims of the subject invention.

In all the references cited by the Examiner, the plasma flows in a very narrow ring that has to be moved along the substrates in order to uniformly coat the substrates. Also, in each of these references the evaporate is distributed in roughly inverse proportion to the distance from the cathode target to the substrate, which results in a very non-uniform coating on a substrate. The combination of direct (unfiltered) cathodic arc deposition with both arc ionized e-beam evaporation and magnetron sputtering is incompatible because cathodic arc evaporate consists of droplets and macroparticles while both e-beam and magnetron sources produce fully atomized metal vapor.

The applicant has invented an arrangement whereby the filtered arc source can be combined with a metal vapour source in a manner that allows all metal evaporators and sputtering sources to be

positioned evenly and equidistantly from the substrates to be coated, resulting in equal distribution of metal vapors from all evaporators and sputtering sources along the substrates. The fully atomized and strongly ionized metal vapours to flow toward the substrates as unidirectional plane-symmetrical stream (rather than an axi-symmetrical annular ring), thus improving the consistency, uniformity and quality of the coating. Other advantages are described below.

Bergmann (US 4,877,505) teaches a combination of two types of sources (and processes) in one chamber: one vacuum cathodic arc deposition, and the other magnetron sputtering (or, as termed in his patent specification, magnetic-field supported sputtering). This is well known in the industry and has been in industrial use from the beginning of 1990s, mostly by Houser, but also by Balzers. This technology was first introduced by Munz and the process is called arc bond sputtering (ABS). In this process the arc is mostly used at the beginning for metal ion etching of the substrates, to secure good adhesion of subsequent magnetron sputtering coatings.

The main disadvantage of this approach is that since they are using a non-filtered arc, the arc vapor plasma although highly ionized contains a large number of droplets or macroparticles – this is a significant disadvantage of direct (non-filtered) arc deposition processes, when the substrate is in optical sight of the target surface. On the other hand, the magnetron sputtering flow has extremely low ionization, mostly consisting of neutral atoms, but no droplets. This aptly shows how incompatible these two metal vapor sources are, and why they are very rarely used simultaneously (in fact they are never used together in an industrial production environment), Rather, they are used in sequence, first arc metal plasma etching followed by magnetron sputtering, as separate sequential processes.

This disadvantage is overcome by the present invention, which for the first time allows for an effective hybrid combination of filtered arc metal plasma flow (fully ionized, yet droplet free) with a direct magnetron sputtering flow (low ionization, droplet free). Exemplary embodiments are shown in Figs. 8b and 8c of the present application. The operational pressure chart presented in Fig.14 shows the compatibility of magnetron sputtering with filtered arc deposition. The rectangular design allows for the combination of large area planar magnetrons with a uni-directional, large area filtered arc flow in the vacuum chamber, providing nearly 100% ionization over a large deposition zone that is theoretically unlimited in a direction parallel to the deflecting conductors).

Further variations of this design (see for example paragraph [0132]) involve placing the magnetron in a filtered arc plasma guide chamber opposite another metal vapor source (for example an arc source or another magnetron or ionization source such as a hollow or thermoionic cathode). In this case the only 100% ionized portion of the metal sputtering flow is extracted from the magnetron sputtering source and directed toward the substrates to be coated along curvilinear (90°) magnetic force line around the deflecting conductors. In this case (with and without other ionized metal vapor) the filtered magnetron sputtering process itself produces a 100% ionized metal vapor plasma flow. Once again, the rectangular design utilizing linear deflecting conductors allows for the integration of a planar magnetron sputtering source with a rectangular cathode target having theoretically unlimited length (in the direction parallel to the deflecting conductors) in the rectangular plasma guide chamber of the present invention, with substrates to be coated off of the optical axis of the magnetron target. There is no teaching or suggestion of this approach or anything analogous to it in the prior art.

Bergmann combines ionized e-beam evaporation (with the crucible being either hot, e-beam heated, cathode or hot anode) and magnetrons. Notably, this is an axially symmetrical arrangement with substrates disposed around the e-beam, which is propagating along the axis of a cylindrical vacuum chamber between a high voltage e-beam cathode (filament) **21** and crucible **12** (see Bergmann Fig.2). It also has to be noted that this system utilizes the main features of Buhl US 4,448,802 and Moll et al. US 4,197,175. The main disadvantage of this design is that the e-beam evaporation/deposition rate is inversely proportional to the distance of the substrates to be coated from the evaporation metal surface (crucible). This will result in non-uniformity of the e-beam evaporated metal vapor deposition rate along the substrates **8**, in addition to a shade effect created by the substrate holders and neighboring substrates (since the e-beam evaporated metal vapor must propagate along straight lines starting at the metal evaporation surface in the crucible). This non-uniformity of e-beam deposition is contrary to the nearly 100% uniform distribution of the coatings deposited by planar magnetrons surrounding the substrates.

When Bergmann's focusing coils are activated to deflect the e-beam evaporated and arc ionized (crucible as hot cathode or hot anode) metal vapor plasma from crucible toward substrates surrounding the crucible, this will result in very narrow deposition zone, located near the center plane of the cusp created by the pair of coils **37**, which are disposed opposite to each other. The way

that the e-beam evaporated metal plasma propagates in Buhl et al. and Moll et al. is via a magnetic field creating a cusp configuration, and a plasma flow starting at the metal evaporation surface and turning 90° along magnetic field lines forming a narrow disc near a center plane of the magnetic cusp, mirroring the magnetic field configuration. This is based on well known phenomenon in plasma physics, that plasma density in a vacuum with strongly ionized plasma is proportional to the magnetic pressure, i.g. $n_e \sim B^2/8\pi$, where n_e is plasma density, B is magnetic field. This effect further reduces the uniformity of a coating deposited by ionized e-beam evaporation, which is a disadvantage of Buhl et al., Moll et al. and Bergmann. In fact such a magnetic field configuration will inevitably adversely affect the uniformity of magnetron coatings as well.

Another significant disadvantage of the design proposed in Buhl et al., Moll et al and Bergmann arises because when they are using a focusing magnetic field they cannot use a modular e-beam source having e-beam emitter (with a filament disposed near the crucible and using a transversal magnetic field to turn the e-beam 180° or 270° from the filament to the crucible). This is physically impossible in those arrangements, since the focusing magnetic field will affect the e-beam trajectory resulting in displacement, defocusing and shifting of the e-beam from the evaporation surface in the crucible. The only possible design in all of these arrangements is positioning the electron gun on top of the chamber and the crucible on the bottom of the chamber, so that the e-beam propagates along the axis of symmetry of the magnetic cusp while the substrates to be coated are disposed around the crucible.

For instance, in Bergmann Fig. 1 the electron gun is positioned on the side wall of the chamber. It can be seen that in this case no focusing magnetic cusp can be applied, or the e-beam will be displaced from the crucible. Similarly, in Buhl Figs. 1 and 2 focusing coils are setup in sequence, to isolate (by means of magnetic isolation) the arc ionized e-beam generated vapor plasma, which will reduce the deposition rate dramatically and further deteriorate the coating uniformity.

This disadvantage is also completely overcome in the present innovation, which in some embodiments utilizes a modular arc-ionized e-beam evaporator with the e-beam turned from the nearby filament toward the metal evaporation surface in the crucible, while the e-beam evaporator is positioned near the centre of the magnetic cusp created by the deflecting conductors in the plasma duct. At this point the absolute value of the magnetic field is below the level which can affect the

trajectory of e-beam. The crucible is positioned in a region close to the center of the magnetic cusp so that the e-beam trajectory will not be substantially affected by deflecting magnetic field and will result in a stable evaporation spot on the surface of the evaporation metal in the crucible.

In a case with only a downstream cusp, as was proposed in US Patent No. 5,435,900 (Gorokhovsky), for example the U-shaped embodiment shown in Fig.2b, the deflection of cathodic arc plasma is provided solely by deflecting conductors. In this case, the deflecting magnetic field has the shape of circles concentric to the deflecting conductors, as illustrated in the following sketch (Fig.4a):

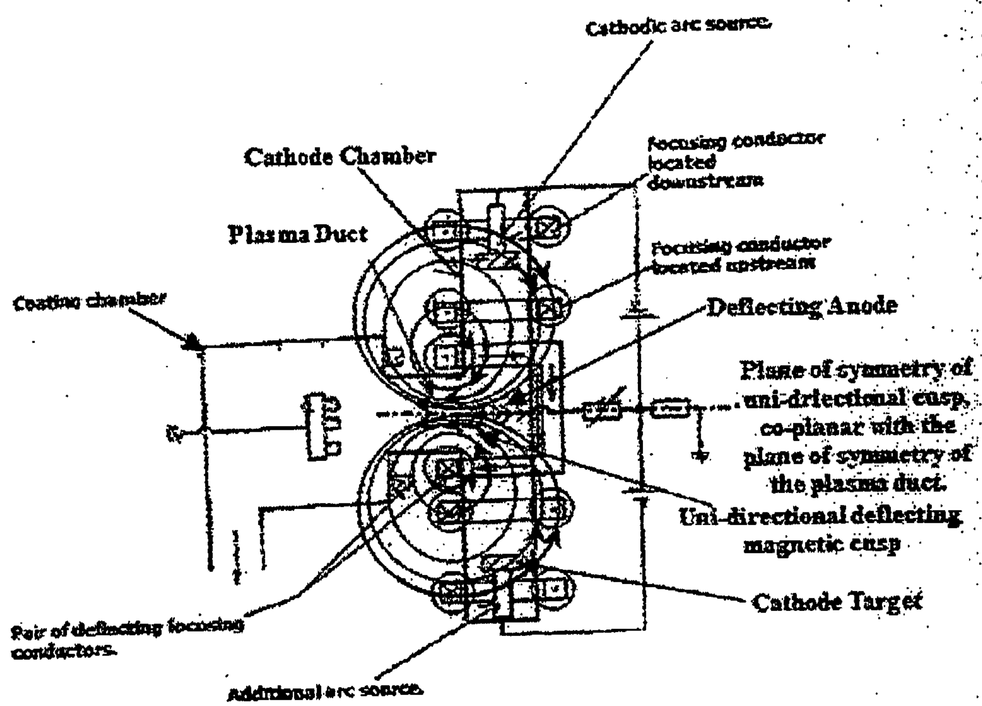

Figure 2B from U.S. patent No. 5,435,900 with illustration of uni-directional magnetic field cusp geometry

Fig.4a.

It can be seen that in this case that a substantial amount of metal vapour plasma will flow in a direction opposite to the coating chamber, and will eventually be lost to the walls of the cathode chamber and the plasma duct.

The reason for this is that in Gorokhovsky the U-shaped embodiment shown in Fig.2b has no closing conductors; only the deflecting conductors disposed adjacent to the coating chamber are used to generate the deflecting curvilinear magnetic field to direct plasma around the deflecting conductor toward coating chamber. There is no region of zero magnetic field in Gorokhovsky, and therefore an e-beam evaporator cannot be installed in the plasma duct.

In the present invention, the closing conductors create an upstream cusp which works in conjunction with the downstream cusp created by the deflecting conductors to create a magnetic 'wall' dividing the upstream and downstream cusps, which is perpendicular to the plane of symmetry of the cusps and effectively serves as another plane of symmetry. In this "dual-cusp" geometry the overwhelming majority of metal vapour plasma is deflected along the magnetic field of the downstream cusp toward coating chamber.

Thus, the most critical distinction between the present invention and the prior art can be explained as follows: In the present invention deflecting conductors create a magnetic cusp (downstream cusp) directed toward coating chamber, while the closing conductors create an opposite magnetic cusp (upstream cusp) directed toward the back wall of the plasma duct, in the direction opposite to the coating chamber. This is illustrated in the following sketch (Fig.4b)

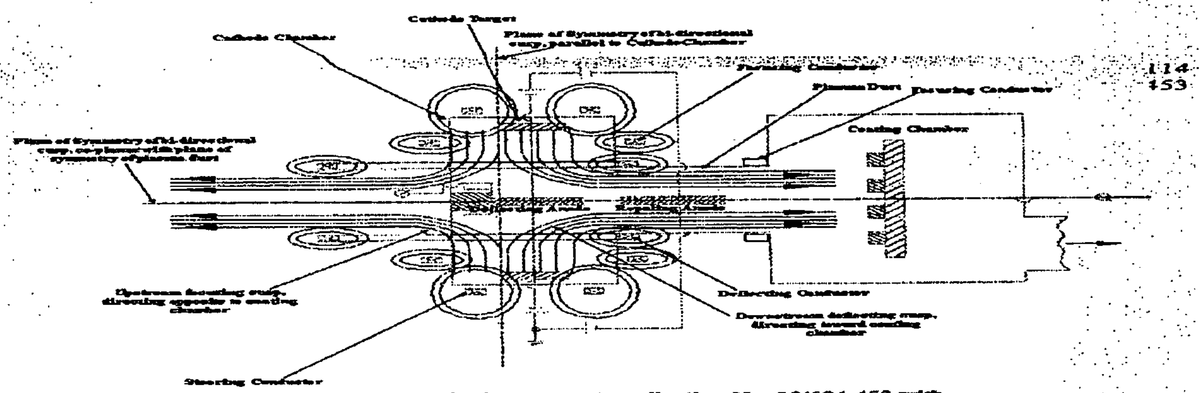

Figure 6A from patent application No. 10/694,453 with illustration of bi-directional magnetic field cusp

Fig. 4b

Metal vapour plasma cannot traverse a magnetic field easily, and instead tends to follow the magnetic field lines. In the present invention, since the cathodes or metal evaporators in the cathode chamber are disposed to the downstream side of the downstream cusp, most of the vapour plasma will flow toward the coating chamber. The vapour plasma is substantially confined by the downstream cusp (a small amount will diffuse into upstream cusp and eventually be lost to the walls of plasma guide and cathode chamber).

The full cusp of the prior art is bi-directional, and has only one plane of symmetry (parallel to the coils and positioned between the coils) in addition to the axis of symmetry, which is coaxial to the coils. In the present invention, as claimed, there are **two planes of symmetry** – one parallel and one perpendicular to the plane of the coils. This provides a number of advantages.

Part of the plasma will be trapped by the upstream cusp and will always go to the back of the chamber, promoting good sustainability between the arc and the anode because the plasma is far more conductive than air (as opposed to prior art, where the plasma is fully confined in the single full cusp of the magnetic field therefore there is a very high resistance between the arc and the walls of the chamber).

A second evaporation source can be installed even though a filtered arc source is also used. In the prior art (for example Moll) the filament can be installed near the crucible, but only because a filtered arc source is not used. This cannot be done if a filtered arc source is also used, because the magnetic field on one side of the cusp is so strong that the electron beam would be diverted from the crucible. In the present invention there is no such limitation because the evaporation source can be installed in a "stagnation zone" between the dual cusps, which is a region of the focusing magnetic field where the deflecting magnetic field is too small to deflect the electron beam from the at least one plasma source.

In the cited references only one crucible can be installed, and the substrates must be installed in an axe-symmetrical arrangement around the crucible. The coating distribution will be non-uniform, not only because the plasma flows in a very narrow disc but also because of the inverse square law and the distance to the substrates. In the present invention (for example, see Fig. 8g), the crucible on the bottom is near the centre of the cusp, the rectangular chamber is theoretically unlimited in length (in a direction perpendicular to the drawing), and there are ***two*** planes of symmetry: One created by the opposite polarity of the deflecting and closing conductors, and another created along the axis of the crucible. As such, any number of crucibles can be installed along the length of the chamber to provide overlapping and uniform coatings. Whereas the prior art cannot mix a droplet-containing flow (such as an arc source, highly ionized) with e-beam or thermal evaporator (low ionization, no droplets), in the present invention the additional plane of symmetry allows this.

The main claims have been amended to recite both the filtered arc source and at least one metal vapor or sputter deposition plasma source installed in the plasma duct, *at least one pair of focusing conductors comprising conductors generating an upstream magnetic cusp in a direction opposite to the deflecting magnetic cusp and extending into the plasma duct, a plane of symmetry*

being defined between the upstream cusp and the deflecting magnetic cusp, and at least one metal vapor or sputter deposition plasma source installed in the plasma duct *in a region between the upstream magnetic cusp and the deflecting magnetic cusp, on the side of the plane of symmetry toward the deflecting magnetic cusp or in a region where the deflecting magnetic field is too small to deflect electrons from the at least one plasma source.* These features are not taught or suggested by the cited references. The applicant submits that for this reason the present claims are allowable.

These features are all supported by the specification. For example, Figure 8 shows closing conductors only for the deflecting conductors, while the focusing conductors are formed as a rectangular coil surrounding the exit opening of the filtered arc source. A quasi-flat plane-symmetrical cusp magnetic field configuration is created with plane of symmetry parallel to deflecting/focusing conductors and substrate arrangements in the coating chamber. This is the plane of symmetry of the entire filtered arc source. The center of the cusp is a line parallel to the deflecting conductors and substrate arrangements. Near this line (which forms a stagnation zone) the magnetic field is near zero. These are also shown in Figures 8m and 8n as conductors 220a,b, which make a cusp magnetic field supporting the arc ionized filtered e-beam evaporation embodiment. The following paragraphs in the disclosure are particularly applicable:

"... [0083] It will be appreciated that because the plasma cannot traverse the deflecting magnetic field lines, in order to fully utilize the cathode target the magnetic cusp generated by the deflecting conductor 20a must be oriented toward the coating chamber 42, to guide the plasma stream toward the coating chamber 42. An opposite cusp, which would lead the plasma stream in a direction opposite the coating chamber, is created by the closing conductors 20b of the deflecting coils 20, as shown in FIG. 3b; thus, the closing conductors 20b are maintained remote from the filtered arc source, and the cathodes 12 must be positioned within the cusp of the magnetic field generated by the deflecting conductor 20a of the deflecting coil 20. Any portion of the plasma outside of the cusp of the deflecting magnetic field will be deflected into the back wall (behind the deflecting electrode portion 30') of the cathode chamber 14, and will not reach the substrates 4.

lines (both filtered arc and other sources in the plasma duct) to be positioned along the axis of symmetry. This cannot be done in axe-symmetrical system like the prior art, only in a plane-symmetrical system such as the present invention, which thus allows for greater flexibility in the number and type of sources that can be used for coating.

This is not the case at all in the cited references. For instance, in Bergmann the magnetron targets are parallel with and equidistant from the substrates, but the cathodic arc sources are installed at butt-ends of his axe-symmetrical arrangement, so the deposition fluxes from the magnetrons are even along the substrates but in inverse proportional to the distance from cathodic arc targets.

Furthermore, because the design of the plasma duct according to present invention is rectangular, and the magnetic cusp created by the linear deflecting and closing conductors (20a, 20b) of the deflecting coils 20 (see Fig. 8f in the present application) is ***plane-symmetrical***, as opposed to ***axe-symmetrical*** as in Buhl, Moll and Bergmann, this allows a theoretically unlimited number of modular ionized e-beam or resistive evaporators to be disposed along the central line of the quasi-flat cusp. The flows of vapor plasma generated by side cathodic arc evaporators are merged with the flow of ionized e-beam metal vapor plasma or resistive evaporated metal vapor (as shown in sketch 3 attached). The positioning of a resistive evaporator ionized metal vapor source is near the stagnation zone (a center line) of the cusp created by deflecting and closing linear conductors (conductors20a, 20b on Fig.8e).

In a still further variation of this design shown in Figs. 8m and 8n, the ionized e-beam evaporator or thermal evaporator is placed in a filtered arc plasma guide chamber opposite to another metal vapor source or ionization source (an arc source or magnetron or ionization source such as hollow or thermoionic cathode). In this case only the 100% ionized portion of the ionized metal evaporation flow is extracted from the crucible and directed toward substrates through the cusp oriented toward coating chamber. The vapor metal plasma is transporting along curvilinear (90°) magnetic force line around deflecting-focusing conductors via plasma duct toward substrate to be coated. In this case (with and without other ionized metal vapor) the filtered vapor metal plasma evaporation (ionized e-beam or thermal resistive evaporation source with hot cathode or hot anode ionization) process itself produces 100% ionized metal vapor plasma flow. Once again, the

[0088] The magnetic deflecting system comprises coils 20 having deflecting conductors 20a proximate to the corners of the plasma duct 46 adjacent to the cathode chambers 44, and closing conductors 20b (for example as shown in FIG. 7) remote from the plasma duct 46 so as not to influence the direction of plasma flow.

[0089] The deflecting magnetic fields generated by the conductors 20a direct the plasma stream toward the substrates 4. As in the previous embodiment, in order to avoid plasma losses the cathodes 12 must be positioned within the cusps of the magnetic fields generated by deflecting conductors 20a of the deflecting coils 20..."

All the different metal vapour sources in the present invention can be positioned along a direction parallel to the linear deflecting and focusing conductors, which is in turn parallel to the substrate setup in the coating chamber. In other words, they are parallel to the plane of symmetry of the rectangular filtered arc source. In this situation both e-beam crucibles, resistive evaporator crucibles and planar magnetron targets (whether in the main chamber, as in Figs, 8b,c or in the cathode compartments for filtered magnetron deposition, as described in a paragraph 132) as well as the primary cathodic arc sources (in the cathode chambers of the filtered arc source) are installed along the direction parallel to the substrates. Thus, the evaporation or sputtering surface for each source is equidistant from the substrates to be coated, yet the distribution of the evaporation/sputtering sources can be equal and uniform for all sources used in each particular embodiment, i.e. filtered arc assisted direct or filtered magnetron sputtering; filtered arc assisted direct or filtered arc ionized e-beam evaporation; filtered arc assisted direct or filtered arc ionized thermal evaporation.

Another important advantage of present invention is the unidirectional sources it provides. Regardless of the positioning and combination of different metal vapour/sputtering sources, they are arranged on one side of the substrates resulting in a unidirectional, evenly distributed (along the substrates) metal vapour stream. In the prior art, if the substrate arrangement is one metre long, then unless magnetron sources or rectangular targets are used, the coating will be non-uniform along the length of the substrate. The present invention allows for cathodes with overlapping magnetic field

rectangular design utilizing linear deflecting-focusing conductors, allows the integration of the planar magnetron sputtering source with a rectangular cathode target having theoretically unlimited length in a direction parallel to the deflecting conductors along the rectangular plasma guide chamber of the present invention, with substrates to be coated off of the optical axis of the metal evaporation surface on crucible. There is no teaching or suggestion of this approach or anything analogous to it in the prior art.

Buhl is similarly an axe-symmetrical arrangement, resulting in very narrow and non-uniform deposition along substrates to be coated 4 (see Buhl Fig.1). The vapor plasma generated by his cathodic arc source target 9 flows along cusp-type magnetic force lines created by pair of opposed magnetic coils 24, 24'. Modulating the magnetic field in one coil relative to the other can move the position of disc-shaped plasma vapor flow along the axis of symmetry of the chamber, but this rastering capability is limited since plasma density diminishes as the distance from the target increases. This is not a case at all in the present invention, because of the rectangular design of the plasma guide and the deflecting magnetic field quasi-flat cusp, created by linear deflecting (and closing) conductors of the deflecting coils.

All other cited patents do not separate vapor plasma flow from droplets, neutrals and macroparticles. This is equally relevant to Ehrich (direct cathodic arc deposition), Klepper (direct cathodic arc deposition using heated cathode target for evaporation boron), and Giersch (laser-induced arc discharge). In all these cases this is direct deposition with optical sight between the target and the substrate surface, and all suffer from the disadvantages of direct deposition processes.

The present invention claims "at least one pair of focusing conductors disposed adjacent to the cathode and the plasma duct on upstream and downstream sides of the cathode, for focusing a plasma flow from the cathode to the plasma duct." In Figure 2b of the Gorokhovsky reference, for example, there are three coils, two on the sides and one back coil. The current flows through the parallel vertical conductors adjacent to the cathodic chamber, then back; but instead of going down, as in the present invention, it continues parallel to the side (see sketch 1, attached). Without the back coil, the current of the closing conductor will create a cusp that will divert part of the plasma to the back of the chamber.

In the present invention as claimed, the back coil (the pair of focusing conductors disposed adjacent to the cathode and the plasma duct on the *upstream* and side of the cathode) has a direction that nullifies the current of the deflecting coil closing conductors. This does not create a full cusp, but rather creates merely a portion of a cusp directed toward the substrates (see the disclosure, paragraph 83). As noted above, the main claims have been amended to recite that the pair of focusing conductors comprising conductors generates an upstream magnetic cusp in a direction opposite to the deflecting magnetic cusp which extends into the plasma duct, defining a plane of symmetry being between the upstream cusp and the deflecting magnetic cusp, and the metal vapor or sputter deposition plasma source is installed in the plasma duct in a region between the upstream magnetic cusp and the deflecting magnetic cusp, on the side of the plane of symmetry toward the deflecting magnetic cusp or in a region where the deflecting magnetic field is too small to deflect electrons from the at least one plasma source, which provides the advantages enumerated above. The cited references do not, alone or in combination, suggest or describe the claimed invention and therefore applicant respectfully requests reconsideration and withdrawal of the rejections based on these references.

Claims 1-26 have been rejected under the judicially created doctrine of obviousness-type double patenting over U.S. Patent No. 6,663,755 in view of Buhl, Gorokhovsky, Ehrich, Giersch or Klepper. The recitation of the pair of focusing conductors comprising conductors generating an upstream magnetic cusp in a direction opposite to the deflecting magnetic cusp which extends into the plasma duct, defining a plane of symmetry being between the upstream cusp and the deflecting magnetic cusp, patentably distinguishes over these references and any combination thereof. Reconsideration and withdrawal of the rejection is therefore respectfully requested.

In view of the foregoing remarks and amendments to the claims, the applicant believes that the claims are now in condition for allowance and such action is respectfully requested.

Applicant invites the Examiner to call the undersigned if clarification is needed on any of this response, or if the Examiner believes a telephone interview would expedite the prosecution of the subject application to completion.

Respectfully submitted,

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